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## Abstract

**Background:** Few studies have directly compared dental procedures provided in public and private insurance plans for enrollees living in dental health professional shortage areas (DHPSAs). We examined the rates for the different types of dental procedures received by 0–18-year-old children living in DHPSAs and non-DHPSAs who were enrolled in Medicaid and those enrolled under Delta Dental of Wisconsin (DDW) for years 2002 to 2008.

**Methods:** Medicaid and DDW dental claims data for 2002 to 2008 was analyzed. Enrollees were divided into DDW-DHPSA and non-DHPSA and Medicaid-DHPSA and non-DHPSA groups.

Descriptive and multivariable analyses using over-dispersed Poisson regression were performed to examine the effect of living in DHPSAs and insurance type in relation to the number of procedures received.

**Results:** Approximately 49 and 65 percent of children living in non-DHPSAs that were enrolled in Medicaid and DDW received at least one preventive dental procedure annually, respectively. Children in DDW non-DHPSA group had 1.79 times as many preventive, 0.27 times fewer complex restorative and 0.51 times fewer endodontic procedures respectively, compared to those in Medicaid non-DHPSA group. Children enrolled in DDW-DHPSA group had 1.53 times as many preventive and 0.25 times fewer complex restorative procedures, compared to children in Medicaid-DHPSA group.

**Conclusions:** DDW enrollees had significantly higher utilization rates for preventive procedures than children in Medicaid. There were significant differences across Medicaid and DDW between non-DHPSA and DHPSA for most dental procedures received by enrollees.

## Introduction

In the United States, approximately 20 percent and 50 percent of children are covered by Medicaid and private dental insurance plans, respectively.<sup>1</sup> In 2011, there were approximately 4,639 Dental Health Professional Shortage Areas (DHPSAs), with 33.3 million residents in the United States.<sup>2</sup> The Surgeon General's,<sup>3</sup> and the Institute of Medicine's reports<sup>4</sup> indicate that many challenges exist for residents of DHPSAs. Yet, few studies have directly compared the receipt of dental procedures among enrollees of public and private insurance plans based on DHPSA status. In addition, studies have reported that children in DHPSAs have lower rates of dental services utilization compared to children living in non-DHPSAs.<sup>5,6</sup> Conversely, the Centers for Medicare and Medicaid Services (CMS) reported that dental service use among Medicaid enrolled children living in counties with and without DHPSA designation in nine states did not differ significantly.<sup>7</sup>

Studies that compared Medicaid and private insurance plan enrollees limit their comparisons to dental visits and variations in the types of dental procedures received by adults.<sup>8-10</sup> For example, Grembowski et al.<sup>8</sup> and Hunt et al.<sup>9</sup> reported that enrollees of private insurance plans had significantly higher rates of dental visits than the uninsured or those on public insurance. Sweet et al.'s<sup>10</sup> study on adults reported that enrollees in public insurance programs were more likely to receive endodontic and extraction procedures. Our study examined rates of various dental procedures received by 0–18-year-old children enrolled in Medicaid and those children of the same age range who had insurance coverage from Delta Dental of Wisconsin (DDW). We also investigated whether differences exist for patients residing in areas designated as DHPSAs. We hypothesized that children enrolled in Medicaid and those living in DHPSAs may not receive regular preventive care and are more likely to use services such as restorative and endodontic procedures. This work is of great

relevance due to the anticipated increases in the number of children enrolled in public insurance programs following the implementation of the Affordable Care Act. In addition, tracking Medicaid enrolled children's dental procedure utilization is important for monitoring and improving program administration and service delivery.<sup>11</sup>

## Methods

The subjects in this study were 0–18-year-old children who were continuously enrolled for at least 6 months during a calendar year in Wisconsin Medicaid and Delta Dental of Wisconsin. This was done to capture information from most children in the Medicaid dataset and to exclude those who were enrolled for shorter durations or intermittent periods during a particular year. The children were divided into four groups based on the type of insurance and residence in or out of a DPHSA (geographic and population group) as designated by Health Resources and Services Administration (HRSA).<sup>2</sup> The four groups were Delta Dental-DHPSA, Delta Dental non-DHPSA, Medicaid-DHPSA, and Medicaid non-DHPSA. Wisconsin Medicaid dental plans were administered as fee-for-service (FFS) plans in 68 counties, and as capitation plans under Health Maintenance Organizations in four Southeastern counties during the study period. This analysis only used data for children in the Medicaid FFS plans, and DDW enrollees residing in the 68 counties (excluding the four southeastern counties) for comparability between the study groups.<sup>12</sup>

Dental treatment procedures were identified based on the Code on Dental Procedures and Nomenclature (CDT) codes and grouped into six categories. All billed procedure codes from D0100 to D0999 were included into the diagnostic procedures category. CDT codes for oral prophylaxis (D1110 and D1120), combined codes for fluoride application and prophylaxis that were phased out in 2007 (D1201 and D1205), fluoride varnish (D1206), fluoride gel application (D1203), and dental sealant placement (D1351) were categorized as preventive procedures. Restorative procedures were divided into two categories: simple (D2000 to D2430) and complex restorative procedures (D2510 to D2999). Endodontic procedures included D3000-D3999 and extraction/surgical procedures included codes for extraction of deciduous teeth (D7111), extraction of erupted teeth (D7140) and extraction of erupted teeth requiring elevation of mucoperiosteal flap (D7210).

## Data analysis

We analyzed enrollment and claims data for 0–18-year-old children enrolled in DDW and Wisconsin Medicaid from 2002 to 2008. The enrollment files of children from both insurance plans contained information on ZIP codes of residence, age and year of enrollment of the child. However, there was no individual-level link between the enrollment and claims data. The claims dataset contained information on the date of treatment delivery (year only for Medicaid) and procedure code for the treatments provided on that date, as well as a unique ID, age, and zip-code of residence of the child receiving the service. Both the enrollment and claims data were aggregated by year, zip-code, and age, and divided into 3-year groups. For each procedure type, the number of children receiving the procedure and the number of times in a year was computed. The claims data allowed computation of the number of children with 1, 2, 3, and so on. procedures of a given type; the number of children receiving zero procedures of a given type was computed by subtracting the number of children with any procedures from the total number of children in the category obtained from the enrollment data.

We performed descriptive analysis to examine the utilization rates for dental treatment procedures received by children in each of the four study groups. Multivariable analysis using over-dispersed Poisson regression modeling with random zip-code effect to account for clustering was performed. This was to test for differences in the rate of dental procedures provided to children in each group after adjusting for age and year of treatment. We also performed analyses to examine the impact of residence in DHPSA, insurance plan type and their interaction on all response levels. Our final regression model had utilization of procedures of each type as the dependent variable, and type of insurance, residence in a DHPSA or non-DHPSA, and their interaction terms as independent variables. All analyses were performed using SAS version 9.3 (SAS Institute Inc., Cary, NC), with PROC GLIMMIX used for the main analysis. A statistical significance level (alpha) of 0.05 was used throughout. This study was approved by the Marquette University's Institutional Review Board.

## Results

The percentage breakdown of the study groups by person-years-of-enrollment (PY), and age is reported in Table 1. The total PY for the seven-year study period was 4,156,997 for Wisconsin Medicaid (DHPSA 1,864,983, non-DHPSA 2,292,014) and 10,182,529 for DDW (DHPSA 2,618,912, non-DHPSA 7,563,617). Table 1 also reports the numbers and

utilization rates (defined as a person having at least one preventive procedure per year) for preventive dental procedures provided per 100 PY for various age groups. Children in the 0–3 and 7–9-year-old age groups had the lowest and highest utilization rates for preventive procedures, respectively. The number of preventive procedures and the utilization rates decreased after age 9 and children in the 15–18-year-old age group had considerably lower utilization rates than 7–9-year-olds. Children in the DDW non-DHPSA group had the most procedures and highest utilization rates of all age groups with the exception of the 7–9-year-old age group among whom Medicaid enrollees had higher rates.

Table 1. Person-Year Enrollment, Average Number of Preventive Procedures and Utilization Rates by Age for Study Groups

Age group	Medicaid						Delta Dental					
	DHPSA*			Non DHPSA†			DHPSA*			Non DHPSA†		
	% PY enrol.‡	No. of prev. procedures¶	Util. rate%§	% PY enrol.‡	No. of prev. procedures¶	Util. rate%§	% PY enrol.‡	No. of prev. procedures¶	Util. rate%§	% PY enrol.‡	No. of prev. procedures¶	Util. rate%§
0–3	18.8	23.8	16	21.3	19.0	13	17.0	37.5	17	18.0	43.6	19
4–6	14.1	106.0	67	15.2	95.0	57	13.8	237.8	74	14.0	259.9	79
7–9	19.2	204.1	88	18.8	198.7	87	15.3	262.2	74	15.4	287.4	80
10–14	23.8	163.2	71	22.5	144.8	69	29.5	226.0	71	29.1	243.1	75
15–18	24.0	53.4	31	22.2	43.8	28	24.5	118.1	64	23.5	126.7	69
Total	174,533			199,915			372,013			1,077,955		

1. \*Dental Health Professional Shortage Area.
2. †Non-Dental Health Professional Shortage Area.
3. ‡Percentage of enrollees by person-year enrollment.
4. ¶Number of preventive procedures per 100 person-years of enrollment.
5. §Preventive procedure utilization rate percentage.

The average number of dental procedures and utilization rates (having at least one procedure per year) per 100 PY of enrollment are reported in Table 2. In general, Medicaid enrollees had fewer preventive and diagnostic procedures and more therapeutic procedures (restorative, endodontic, and extraction procedures considered together) compared to children in the DDW group. Children in the DDW non-DHPSA group received the most procedures (172.7 and 189.0 per 100 PY) and had the highest utilization rates (66 and 65 percent) for diagnostic and preventive procedures, respectively. Children in the

Medicaid non-DHPSA group had the lowest utilization rates and fewest diagnostic (52 percent) and preventive procedures (49 percent). When compared to children in the non-DHPSA group, Medicaid enrolled children in DHPSA regions had higher utilization rates and higher average number of procedures of all types, except for endodontic procedures.

Table 2. Average Number of Procedures and Utilization Rates for Various Dental Procedures by Person-Years of Enrollment (PY)

Procedure type	Medicaid				Delta Dental			
	DHPSA		Non DHPSA		DHPSA		Non DHPSA	
	No. of procedures*	Utilization rate % <sup>†</sup>	No. of procedures*	Utilization rate % <sup>†</sup>	No. of procedures*	Utilization rate % <sup>†</sup>	No. of procedures*	Utilization rate % <sup>†</sup>
Diagnostic	127.0	57	121.1	52	161.5	62	172.7	66
Preventive	110.3	53	98.2	49	174.7	61	189.0	65
Simple restorative	66.3	22	59.6	20	50.3	19	47.8	19
Complex restorative	14.0	5.0	13.2	5.0	3.4	1.7	2.9	1.6
Endodontic	5.9	3.5	6.2	3.4	3.0	1.9	2.8	1.8
Extractions	11.4	6.1	10.1	5.5	8.3	4.2	8.0	4.0

1. \*Average number of dental procedures provided per 100 PY.
2. <sup>†</sup>Utilization rates defined as having at least one procedure per year.

Table 3 reports the percentage of children from the study groups who received only one, and those who received more than one therapeutic procedure. Medicaid enrollees received all the treatment procedures at higher rates than children in Delta Dental, except when “one simple restorative procedure” was considered. They also received complex restorative, endodontic and extraction procedures, at almost twice the rates of children in DDW.

Table 3. Utilization Rate Percentages for Restorative, Endodontic, and Extraction Services

Procedure type	Medicaid				Delta Dental			
	% With only one procedure in a year		% With two or more procedures in a year		% With only one procedure in a year		% With two or more procedures in a year	
	DHPSA	Non DHPSA	DHPSA	Non DHPSA	DHPSA	Non DHPSA	DHPSA	Non DHPSA
Simple restorative	7.1	6.4	15	14	7.4	7.6	12	11
Complex restorative	2.2	2.3	2.8	2.6	1.0	0.9	0.7	0.7
Endodontic	2.2	2.1	1.3	1.3	1.3	1.2	0.6	0.6

Procedure type	Medicaid				Delta Dental			
	% With only one procedure in a year		% With two or more procedures in a year		% With only one procedure in a year		% With two or more procedures in a year	
	DHPSA	Non DHPSA	DHPSA	Non DHPSA	DHPSA	Non DHPSA	DHPSA	Non DHPSA
Extractions	3.4	3.2	2.7	2.4	2.1	1.9	2.1	2.0

In Table 4, we report the utilization rate ratios from multivariable analysis for determining the impact of residence in DHPSA designated areas and type of insurance and their interaction after adjusting for age, year of treatment and random ZIP-code effects. For both insurance plans, children residing in areas with DHPSA designation were used as the reference population and compared to children in the non-DHPSA group. Among Medicaid enrollees, children residing in non-DHPSA areas had significantly fewer procedures of all procedure types which were examined than those in the DHPSA group, except for endodontic procedures. Among DDW enrollees, those in the non-DHPSA group had more diagnostic and preventive procedures, and fewer restorative, endodontic, and extraction procedures than enrollees in DHPSA group. In the analysis which compared the DDW non-DHPSA group to Medicaid non-DHPSA group, as well as the analysis which compared DDW-DHPSA group to Medicaid DHPSA group, we found that children in the DDW group had more diagnostic and preventive procedures, and fewer restorative, endodontic and extraction procedures than those in the Medicaid group. Children in DDW group had 1.79 (CI 1.78–1.80) times as many preventive procedures and 0.27 (CI 0.26–0.28) times as many complex restorative procedures when compared to the Medicaid group. Children in DDW-DHPSA group had 1.53 and 0.25 times as many preventive and complex restorative procedures, compared children in Medicaid-DHPSA group.

Table 4. Utilization Rate Ratios (95% CI) Examining the Effect of Residence in DHPSAs and Insurance Type

Procedure type	Medicaid non-DHPSA versus DHPSA	Delta Dental non-DHPSA versus DHPSA	Interaction ratio*	Delta Dental DHPSA versus Medicaid DHPSA	Delta Dental Non-DHPSA versus Medicaid non-DHPSA
1. *Rate ratio for differential impact (interaction) of residence in DHPSA/non-DHPSA across the insurance plans.					
2. †Indicates $P < 0.05$ .					
Diagnostic	0.96 <sup>†</sup> (0.94,0.99)	1.08 <sup>†</sup> (1.06,1.10)	1.12 <sup>†</sup> (1.11,1.13)	1.22 <sup>†</sup> (1.21,1.22)	1.36 <sup>†</sup> (1.36,1.37)
Preventive	0.91 <sup>†</sup> (0.88,0.93)	1.06 <sup>†</sup> (1.04,1.09)	1.17 <sup>†</sup> (1.16,1.18)	1.53 <sup>†</sup> (1.52,1.54)	1.79 <sup>†</sup> (1.78,1.80)
Simple restorative	0.87 <sup>†</sup> (0.84,0.90)	0.94 <sup>†</sup> (0.91,0.97)	1.08 <sup>†</sup> (1.06,1.10)	0.78 <sup>†</sup> (0.77,0.79)	0.84 <sup>†</sup> (0.83,0.85)

Procedure type	Medicaid non-DHPSA versus DHPSA	Delta Dental non-DHPSA versus DHPSA	Interaction ratio*	Delta Dental DHPSA versus Medicaid DHPSA	Delta Dental Non-DHPSA versus Medicaid non-DHPSA
Complex restorative	0.90 <sup>±</sup> (0.83,0.97)	0.98 (0.90,1.06)	1.09 <sup>±</sup> (1.03,1.14)	0.25 <sup>±</sup> (0.24,0.26)	0.27 <sup>±</sup> (0.26,0.28)
Endodontic	1.02 (0.96,1.08)	0.97 (0.91,1.03)	0.95 <sup>±</sup> (0.90,1.00)	0.53 <sup>±</sup> (0.51,0.55)	0.51 <sup>±</sup> (0.49,0.52)
Extractions	0.89 <sup>±</sup> (0.85,0.92)	0.95 <sup>±</sup> (0.92,0.99)	1.07 <sup>±</sup> (1.03,1.11)	0.71 <sup>±</sup> (0.69,0.73)	0.76 <sup>±</sup> (0.74,0.78)

In Table 4, we also report findings from the analysis to examine if there was a differential impact (interaction) of residence in DHPSA across the insurance plans. We found that the impact of living in a DHPSA may be lower on children in Medicaid than those in DDW. Children in Medicaid DHPSA's had more procedures (except endodontic) vis-à-vis the non-DHPSA group in comparison to the DDW group. The interaction ratio provided in the table quantifies the comparison of the effect of DHPSA/non-DHPSA between Medicaid and DDW: it is the ratio of the two relative rates. For example, among children insured by Medicaid, those living in a non-DHPSA had a 0.91-fold lower rate of preventive procedures, while among children insured by DDW, those living in a non-DHPSA had a 1.06-fold higher rate of preventive procedures, resulting in an interaction rate ratio of  $1.17 = 1.06/0.91$ .

## Discussion

This study documents differences in dental procedures between enrollees of public and private insurance plans living in dental health professional shortage areas (DHPSA) and non-DHPSAs in Wisconsin. We found that the children enrolled in public insurance plans received fewer preventive procedures and more restorative, endodontic and extraction procedures compared to those in private insurance plan. Our findings are fairly consistent with previous studies related to dental procedure utilization which reported higher preventive service use among privately insured populations and greater use of therapeutic procedures among publicly insured individual.<sup>10,13</sup>

Studies show that regular preventive care is effective in preventing dental caries.<sup>14,15</sup> In this study, the number of preventive procedures per 100 PY, across all the age groups, was considerably lower among Medicaid enrollees in comparison to DDW enrollees (79 percent more preventive procedures) even when the utilization rates were similar. This could be a reflection of Medicaid enrollees having higher dental caries experience which prevented them from receiving more preventive procedures such as dental sealants. Notwithstanding, it is important to note that we compared populations that are inherently

different in their socio-economic status, and living in a large geographic area with significant variation in racial distribution, levels of urbanization. All of these factors can have an impact on dental utilization and/or parental attitudes towards preventive dental care.<sup>5,6,16,17</sup>

Another important finding is that utilization rates for preventive procedures among Medicaid enrollees were greater than (>50 percent) the rates reported in previous studies.<sup>18,19</sup> Higher utilization rates among Medicaid-enrolled children may be attributed to policy initiatives in Wisconsin such as allowing physicians to be reimbursed for fluoride varnish treatment, which has led to a significant increase in FVT use.<sup>20</sup> Also, Wisconsin has in place, a successful school based sealant program (SBSP) that served approximately 10,000 children in 2008,<sup>21</sup> which may explain the higher utilization rates in the 7–9-year-old Medicaid enrollees. In addition, the higher rates in this study could have also been due to differences in our study design such as length of enrollment in the Medicaid program which serves as a strong predictor of use of dental services.<sup>19</sup> Furthermore, for comparability between the study groups, we excluded enrollees from the four southeastern counties of Wisconsin which are the most urban and heavily populated areas of the State. In a previous analysis, we found that the utilization rates among DDW enrollees in this region were generally lower when compared to other parts of the state.<sup>17</sup> So, the overall utilization rates may have been lower if enrollees from the southeastern counties were included in the study.

We found that DDW enrollees had significantly higher rates of diagnostic procedures than enrollees in Medicaid. This finding is similar to previous research into medical diagnostic procedures which found that the rates of diagnostic procedures were higher among people with private insurance plans.<sup>22-24</sup> However, it is important to note that diagnostic procedures, by themselves, do not improve health status and in healthy patients there should be less frequent diagnostic procedures performed. Our findings may indicate an over-use of diagnostic procedures (particularly radiographs) in children covered by DDW insurance. To improve the use of diagnostic procedures, it is important to follow current principles that include the use of risk models to inform use of diagnostic and prevention interventions to prevent potential waste of resources.<sup>24</sup>

In our analysis, the percentage of children receiving two or more restorative, endodontic and extraction procedures were considerably higher than that of those receiving one restorative, endodontic or extraction procedure among Medicaid enrollees. Also, a larger percentage of children enrolled in Medicaid had more restorative, endodontic

and extraction procedures than those in DDW which indicates poorer oral health status among Medicaid enrollees when they accessed dental care.

Another goal of this study was to examine the rates for the different types of dental procedures received by 0–18-year-old children enrolled in Medicaid (fee-for-service plans) and Delta Dental of Wisconsin (DDW) for those living in DHPSA and non-DHPSA regions for 2002-2008. Among the Medicaid enrollees, children living in DHPSAs had higher utilization rates than those in non-DHPSAs for most procedures examined. For example, there was higher utilization rates for preventive and diagnostic procedures consistent with report from a federal agency.<sup>2</sup> The Centers for Medicaid and Medicare (CMS) report found no differences in the use of preventive procedures between children living in DHPSA and non-DHPSA regions among Medicaid enrollees. The CMS report postulated that the Medicaid policies in DHPSA counties were successful in assuring access to care for enrollees in those areas.<sup>2</sup> Also, some of the DHPSA-designated census tracts in this study were in urban regions where availability of providers is higher and may have led to better access to services and in turn higher rates of utilization among the children.

## **Strengths and limitations**

A key strength of this study is the use of a large sample size and data from multiple years that gives a more balanced and comprehensive view of the use of dental procedures across the study groups. Certain limitations must, however be acknowledged. We did not have a direct link between enrollment and claims information, which precluded longitudinal analyses examining utilization within an enrollee across study years. Some enrollees may have had continuous coverage while others may have had intermittent coverage and some may have moved between the two payers (DDW and Medicaid) over the seven-year period. Similarly, some individuals may have lived in DHPSAs for shorter durations than others. These factors could have impacted our study findings as they can lead to potential differences in access to dental care. Factors such as overtreatment in one study group and differences in patient and/or provider preferences may have also lead to the differences we identified.

## **Conclusions**

This study demonstrates that DDW enrollees had significantly higher rates of utilization for preventive procedures than children in Medicaid. The increased use of complex restorative and endodontic treatment procedures by children in Medicaid may reflect higher burden of disease and be associated with lower access to care. More studies

are needed to better understand the factors that lead to differences in utilization rates across these insured populations and to alleviate such differences.

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